MAGNETIC MEASUREMENTS PLAN FOR SNS ¼ CELL ASSEMBLY

Animesh Jain, March 26, 2003 (D R A F T)

1. Purpose:

(1) To determine the changes in transfer function and field quality due to proximity of a neighboring element (21Q40, 27CDM30 or a Sextupole), even though the neighboring element is not powered. (*Mere Presence* Effect.)

(2) To determine additional influence on transfer function and field quality, if any, when the neighboring element is powered at some nominal value.

2. Measurement Plan Summary:

The elements (quadrupole, corrector, sextupole) to be used will first be measured individually on the granite table (or any other suitable location). These elements will then be assembled into a ¼ cell (1/2 cell minus the dipole) and the assembly will be measured – first by powering one magnet at a time, and then with at least two neighboring magnets powered simultaneously.

3. Magnet configuration:

All measurements will be carried out with the coil drive on the corrector end of the assembly. The locations and orientations of various magnets in the assembly are shown schematically in the following figure (Fig. 1):

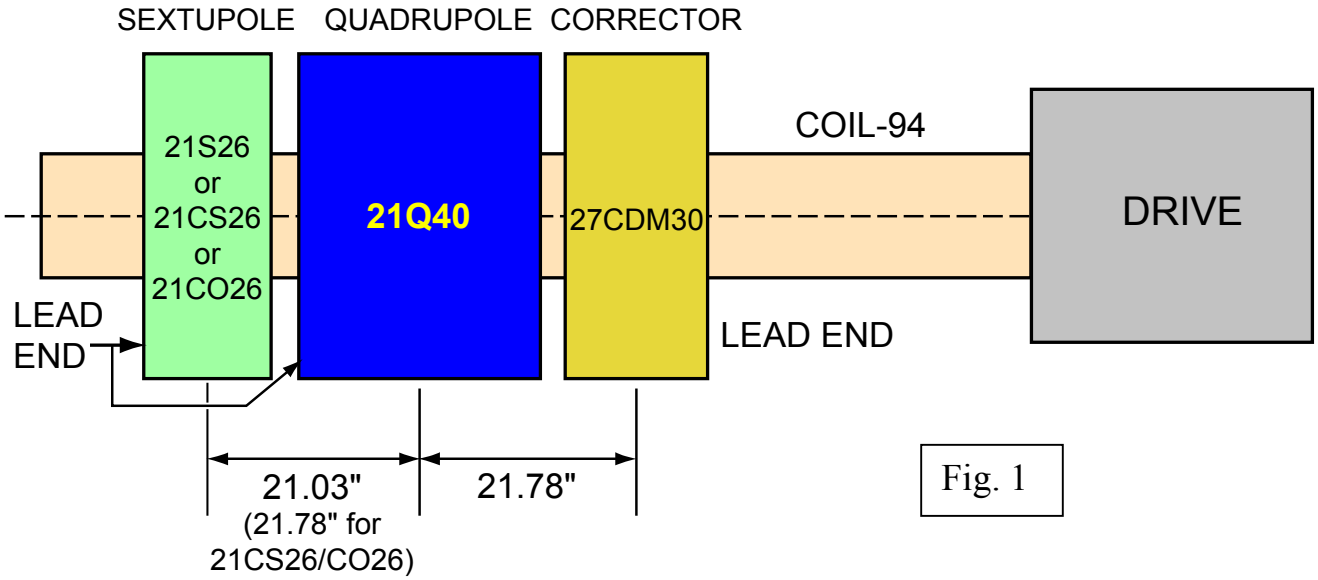

Fig. 1

While measuring individual magnets on the granite table (or any other suitable location), **it is important to maintain the magnet orientation with respect to the coil drive.** The measuring coil should be **axially centered in the 21Q40 quadrupole** – both for measurement of the magnet alone, as well as for measurements on the assembly. **For individual measurements of sextupole or corrector, the measuring coil should be offset, as per the above sketch,** such that these measurements are made using the same section of the measuring coil that would be used for measurements in the assembly.

4. Measuring Coil:

It is proposed that the recently retired coil-94 (used for SNS 17D120 dipoles) be used for these measurements. This coil is sufficiently long (2.49 meter; 98 inches) to cover the integral field from all the three magnets on the assembly. It is also of a sufficiently large radius (81.9 mm; 6.45 inch diameter) to measure harmonics accurately at 80 mm radius.
To prepare this coil for these measurements, it is necessary to carry out the following:

(1) **Make an aluminum or brass sleeve** that can be mounted to the drive cage. The far end should be closed, with a bearing support to hold the coil. This would allow the coil to be operated in a stand alone mode. It should be ensured that the overall OD of the sleeve is well within the available aperture.

(2) Make a mark on the sleeve corresponding to the axial centerline of the coil winding.

(3) **Attach the coil to a drive**, and complete all the wiring.

(4) Check the connections etc. by running the coil in a calibration dipole and/or quadrupole.

If, for any reason, it is not feasible to use coil-94, the alternative would be to use the long coil for RHIC 13 cm quadrupoles, Coil-92. This coil is 4.76 meter long (much longer than needed), and is ready for use. However, the coil radius is only 59.8 mm, which is not suitable for harmonics measurements at 80 mm.

It is **not necessary** to install gravity sensors for these measurements.

5. Measurement Plan for Individual Magnets:

(A) 21Q40 Quadrupole:

(1) Place the magnet on the granite table, with the lead end AWAY from the coil drive end.

(2) Attach power supply cables, water hook up, lead covers, etc.

(3) Install the measuring coil, axially centered in the quadrupole; drive end towards the NON-LEAD END.

(4) Measure a high field excitation curve, as per the usual run plan.

(B) 27CDM30 Corrector:

(1) Place the magnet on the granite table, with the lead end TOWARDS the coil drive end.

(2) Attach power supply cables, etc.

(3) Install the measuring coil, with the magnet center 21.78 inch from the coil center, TOWARDS the drive end. (See Fig. 1.) Accuracy of 0.25 inch is OK.

(4) Measure positive and negative DC loops to 12 A, as per the usual run plan.

(C) 21S26 Sextupole (We will need a 250A power supply for this):

(1) Place the magnet on the granite table, with the lead end AWAY from the coil drive end.

(2) Attach power supply cables, etc.

(3) Install the measuring coil, with the magnet center 21.03 inch from the coil center, AWAY FROM the drive end. (See Fig. 1.) Accuracy of 0.25 inch is OK.

(4) Measure DC loops. Detailed run plan will be provided later.

6. Measurement Plan for Assembly:

It is envisioned that these measurements will be made in the annexe of Bldg.902, adjacent to the granite table area. We will need up to three different power supplies, **and the ability to read three currents (128 values per coil revolution)**, for these measurements. This will most likely involve some software modifications.

A detailed run plan is not worked out yet. It will be provided as we get closer to these measurements.